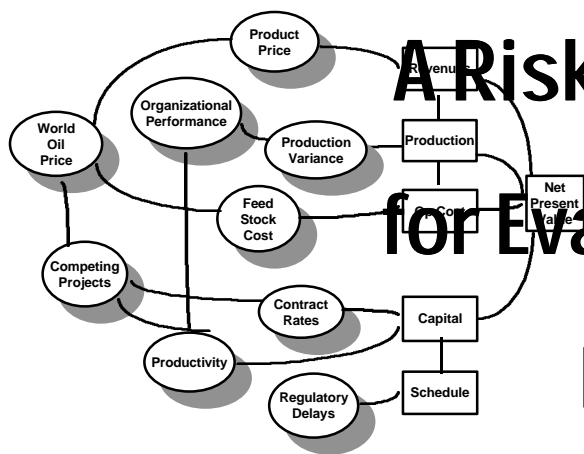


Influence and Tornado Diagrams



A Risk Assessment Method

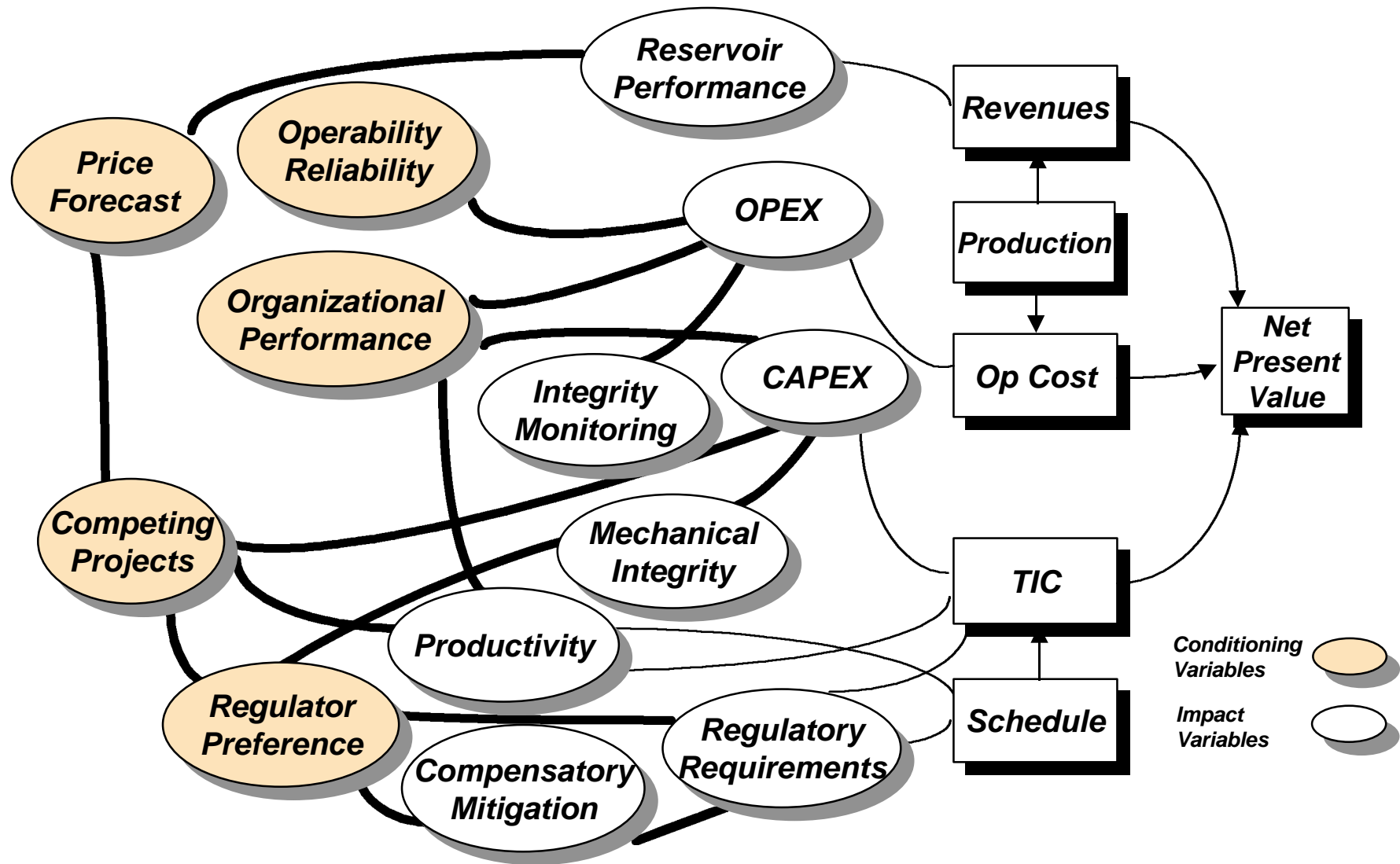
for Evaluating the Impact of

Perceived Risks

on the Life Cycle Costs of a Project

THE INFLUENCE DIAGRAM

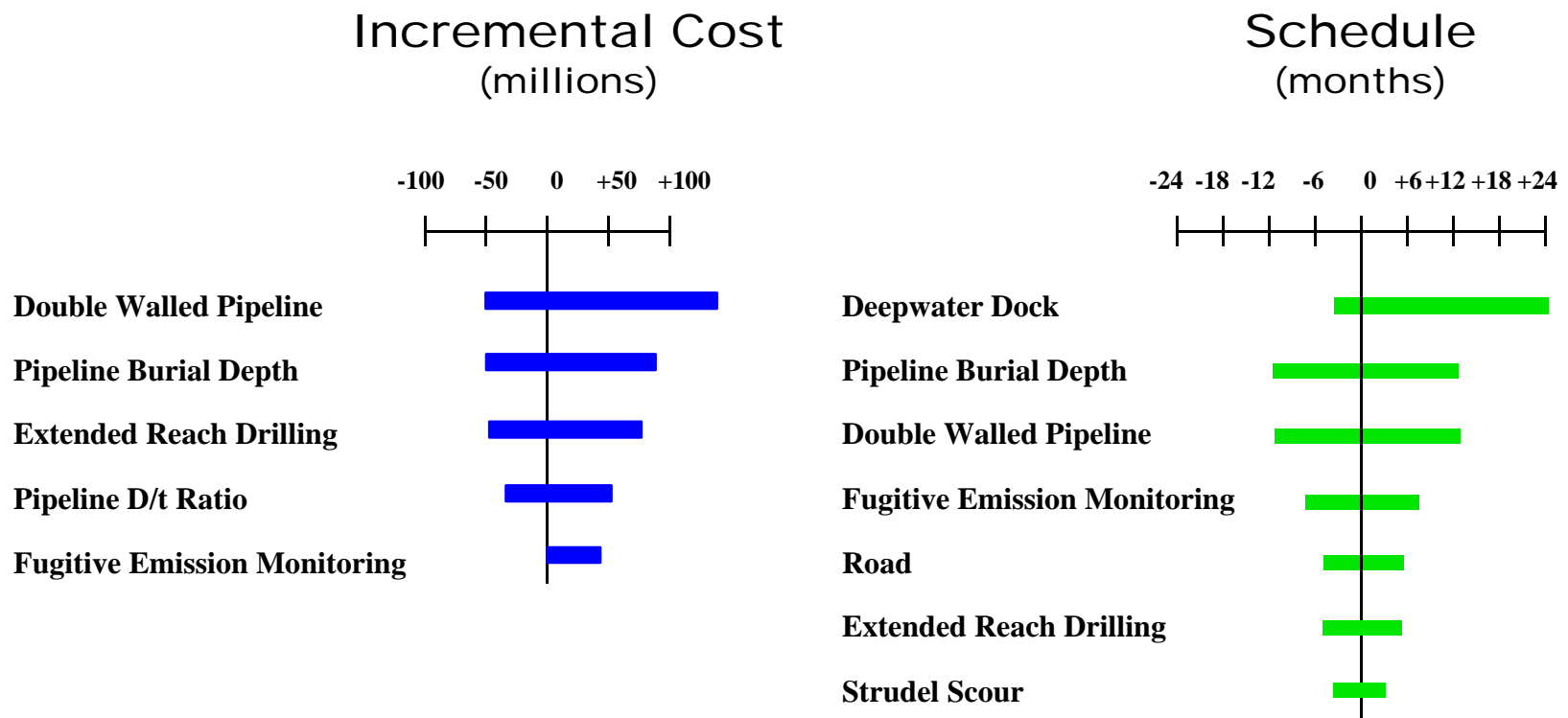
Shows how the risks influence each other and the value of the project.



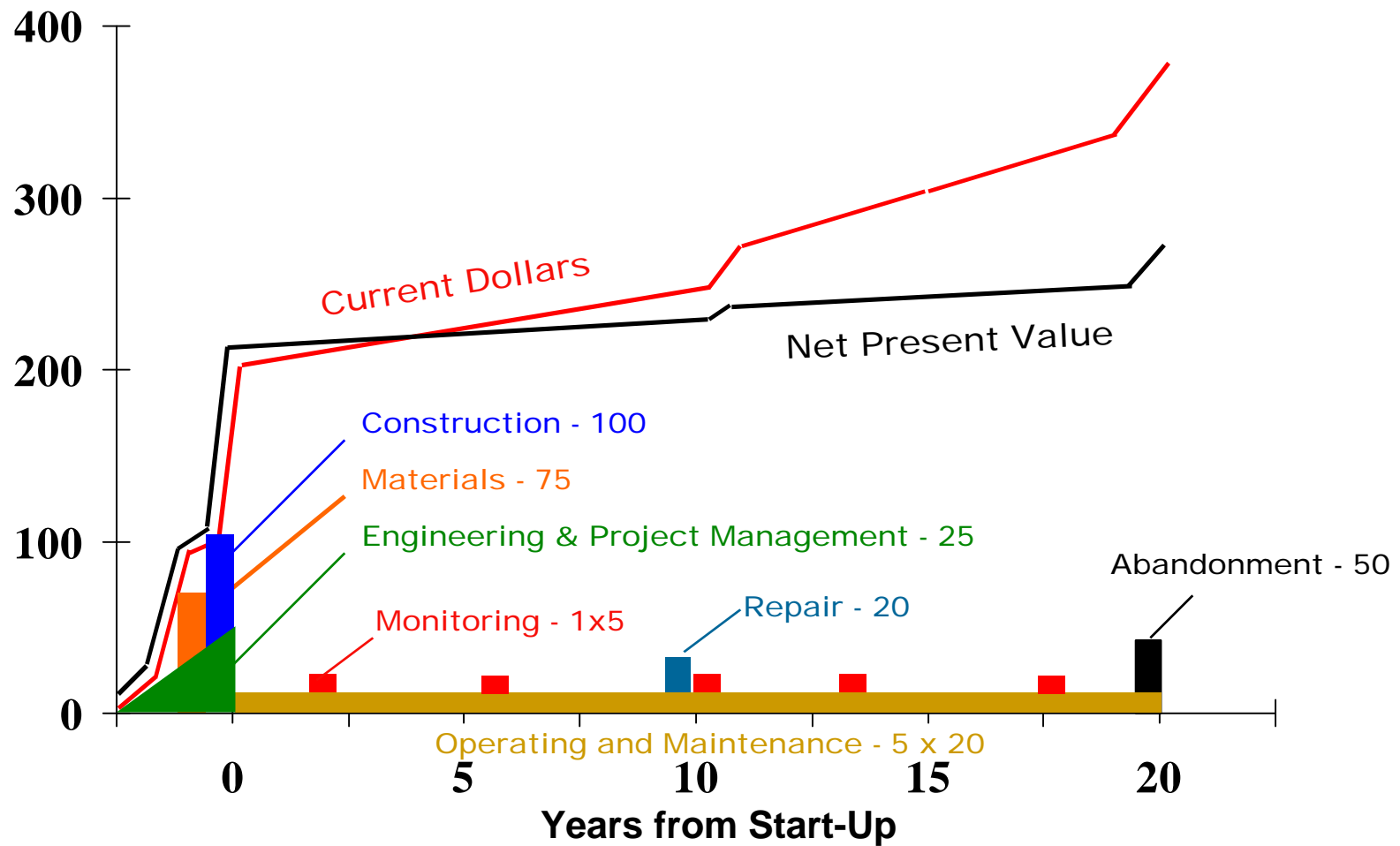
THE TORNADO DIAGRAM

Indicates the key contributors to the uncertainty.

These are the prioritized risk issues for which mitigation should be considered.



LIFE CYCLE COSTS



*Application of **RISK ANALYSIS** techniques to quantify the impact of Perceived Environmental and Permitting Risks on **LIFE CYCLE PROJECT COSTS**.*

+ *Why is an analysis method needed?*

+ *How is good Risk Analysis done?*

+ *How can risk analysis be applied to perceived environmental and permitting risks?*

In 1989, the RAND Corporation conducted a study of pioneer processing plants and mega projects to gain a better understanding of cost overruns and shortfalls in performance.

- **They analyzed 44 process plants and 52 mega projects from around the world.**
- **Significant cost overruns during construction were quite common, especially with pioneer process plants.**
- **Many projects also underestimated the production capability and the time needed to achieve full capacity.**

Pioneering projects in frontier regions are vulnerable to similar uncertainties.

Highlights of the RAND findings follow.....

The RAND study suggests five primary causes of cost growth.

Project definition

The better the definition, the better the accuracy of the estimate.

Novel Technology

Doing something different, even slightly different, increases cost, schedule slippage, and dramatically increases the probability of operational problems.

Complexity & Size

The more complex the project, the more difficult it is to estimate cost and performance. Cost overruns are greater on larger projects.

Management

Management procedures employed by the project have a direct effect on the actual cost outcomes. Continuity of management is an important contributor.

Conflict

Conflict between the project and regulatory requirements is a major factor affecting cost and schedule.

The RAND study recommends the following strategies to make mega projects less risky.

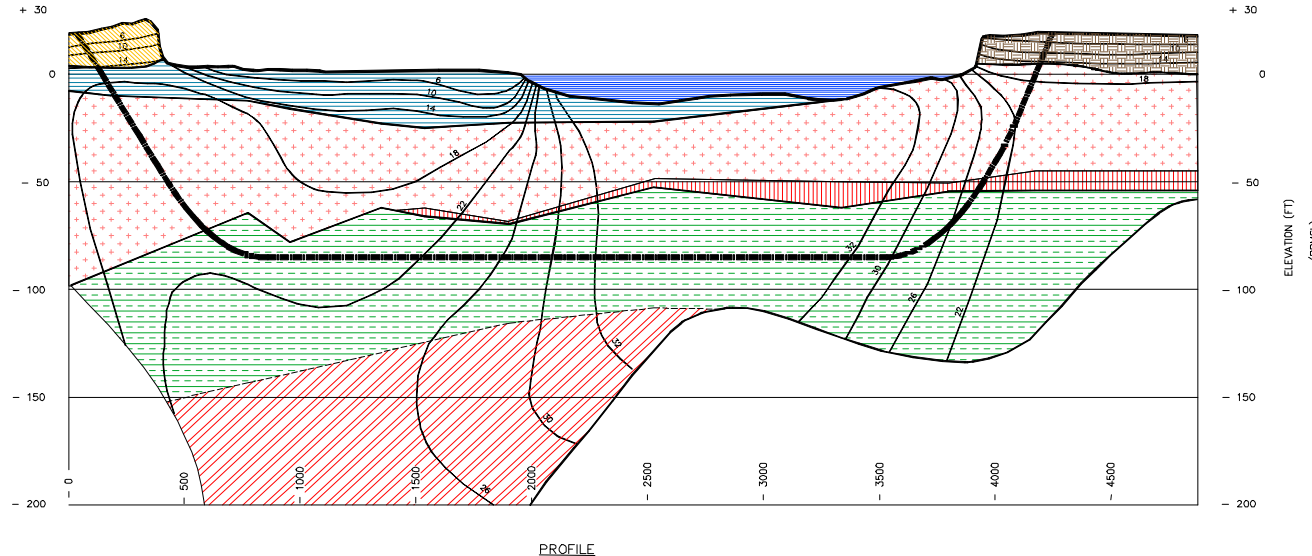
- 1. Significantly broaden the scope of the project definition phase to rigorously and systematically include cultural, linguistic, legal, and above all, political factors, i.e. environmental. Include the “soft” variables in the analysis.*
- 2. Train project managers to be geared at least as much to the project’s institutional environment as to the internal project organization. Broaden their view to include the comprehensive picture.*
- 3. Question whether the introduction of proposed new technology, construction techniques, management techniques, or design approaches is absolutely essential to the mission of the project.*

Applying risk analysis to perceived environmental and permitting risks can improve project performance in all three areas.

Colville River - Crossing Design



- Crossing Length = 4300 feet
- Migration Setbacks
 - Habitat - 300 foot
 - Channel -105 -115 feet
 - Design Scour Elev = -23 feet
- Bore Elevation = -85 feet (Gubik formation)
- Entry/Exit Angle 10°-16°
- Design Radius = 2500 feet

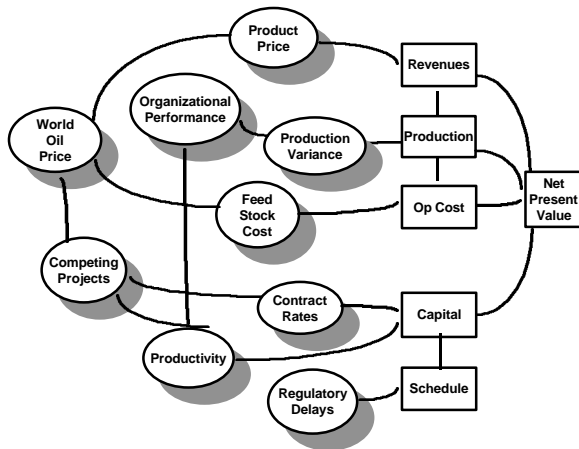






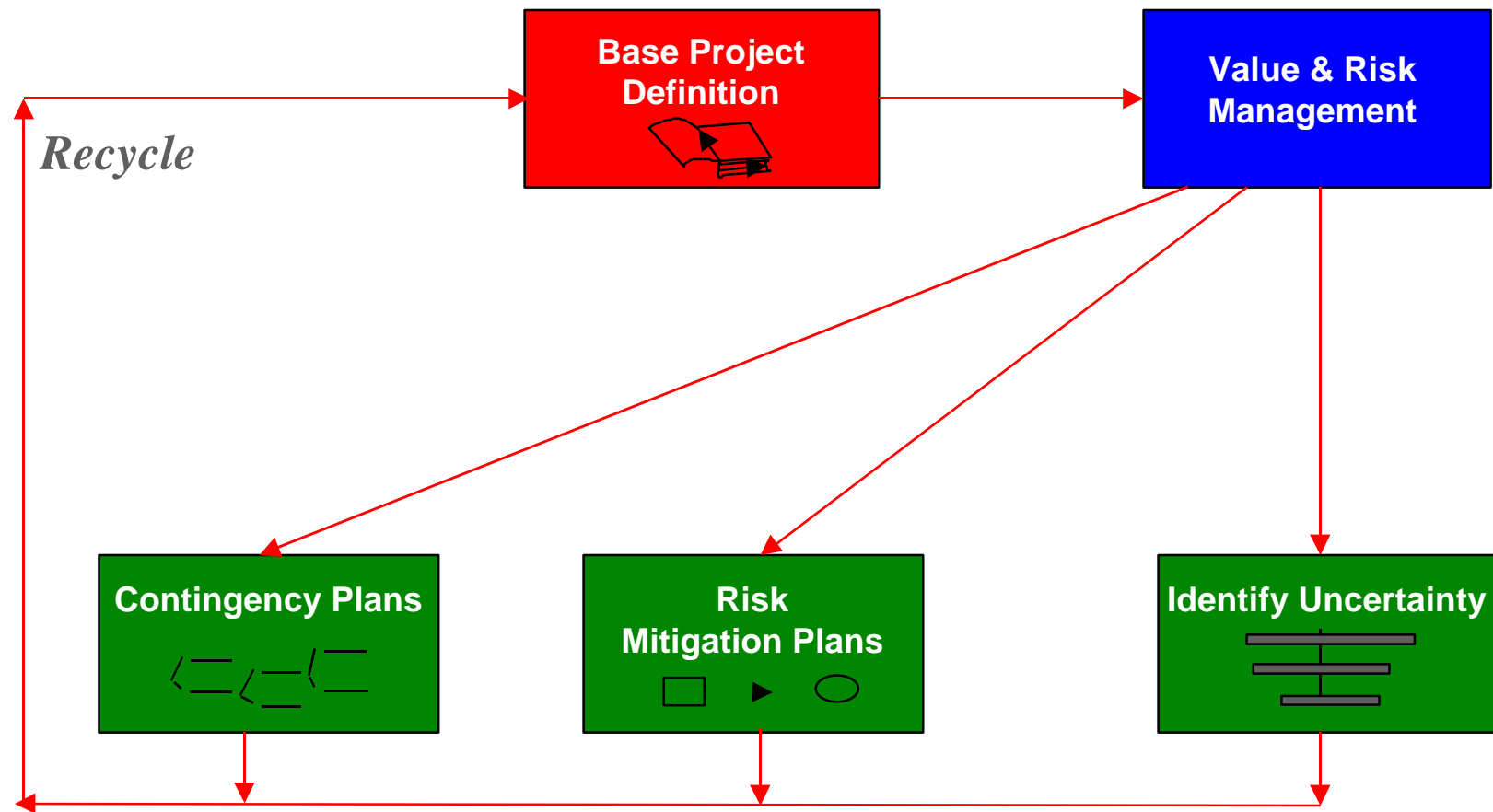
Risk & Decision Analysis provides a method to quantify uncertainties and improve the quality of key project decisions.

➔ *It can be applied to any situation where there are **significant uncertainties**; it is ideally suited for the development and management of frontier projects.*



➔ *It calculates the likelihood of project outcomes based on the **uncertainty in the project**.*

Risk Analysis is the centerpiece of the Risk Management Process

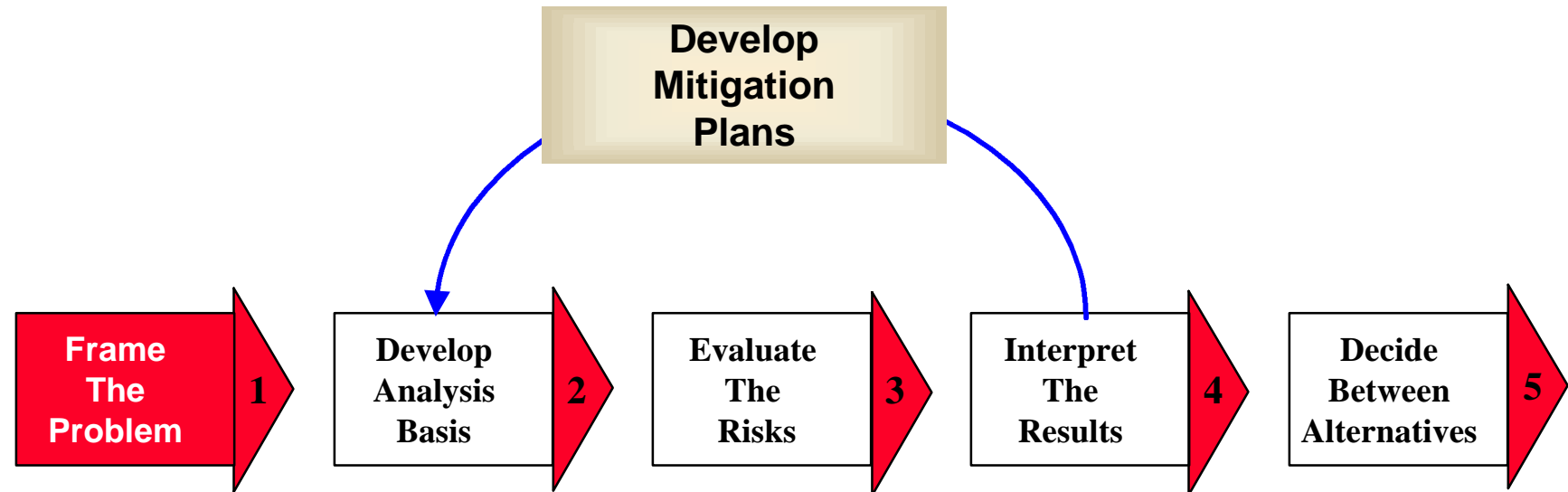


Good risk management is comprehensive in its analysis of the life cycle costs and perceived risks.

- ▶ *Major sources of **risk and opportunity** are identified.*
- ▶ *The best **expert judgments** about the likelihood of uncertain events are captured and their impacts are quantified.*
- ▶ *The most **important risks** are identified and **communicated** to the project stakeholders.*
- ▶ *Performance targets are set at **appropriate confidence levels**.*
- ▶ *Opportunities for **risk mitigation** are analyzed.*
- ▶ *Alternate project strategies are tested to assess the cost and effectiveness of **contingency and mitigation plans**.*



THE RISK & DECISION ANALYSIS PROCESS



Develop Alternative
Strategies.

Identify Important
Sources of
Uncertainty.

Step 1, ***“FRAMING THE PROBLEM”***

Often the most difficult but most valuable step in the process.

♦ There are two sources of uncertainty:

- ✓ *RISKS*
- ✓ *DECISIONS*

♦ Identify areas of uncertainty.

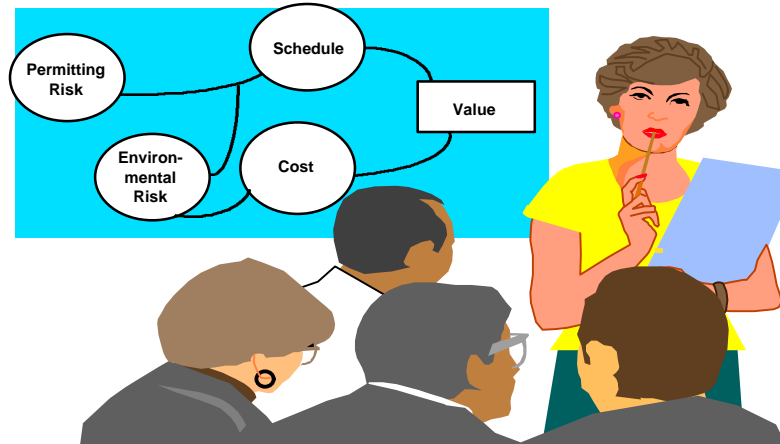
♦ Generate attractive alternatives:

- ✓ *regulators*
- ✓ *management*
- ✓ *project team*
- ✓ *technical specialists*
- ✓ *construction specialists*
- ✓ *environmentalists*



GRAPHICAL TECHNIQUES FOR THE FRAMING STEP

- The Strategy Table
 - *lays out the decision options and the alternatives*
- The Decision Map
 - *illustrates the logic and timing of key project decisions*
- The Influence Diagram
 - *illustrates the relationships between uncertain variables and outcomes*



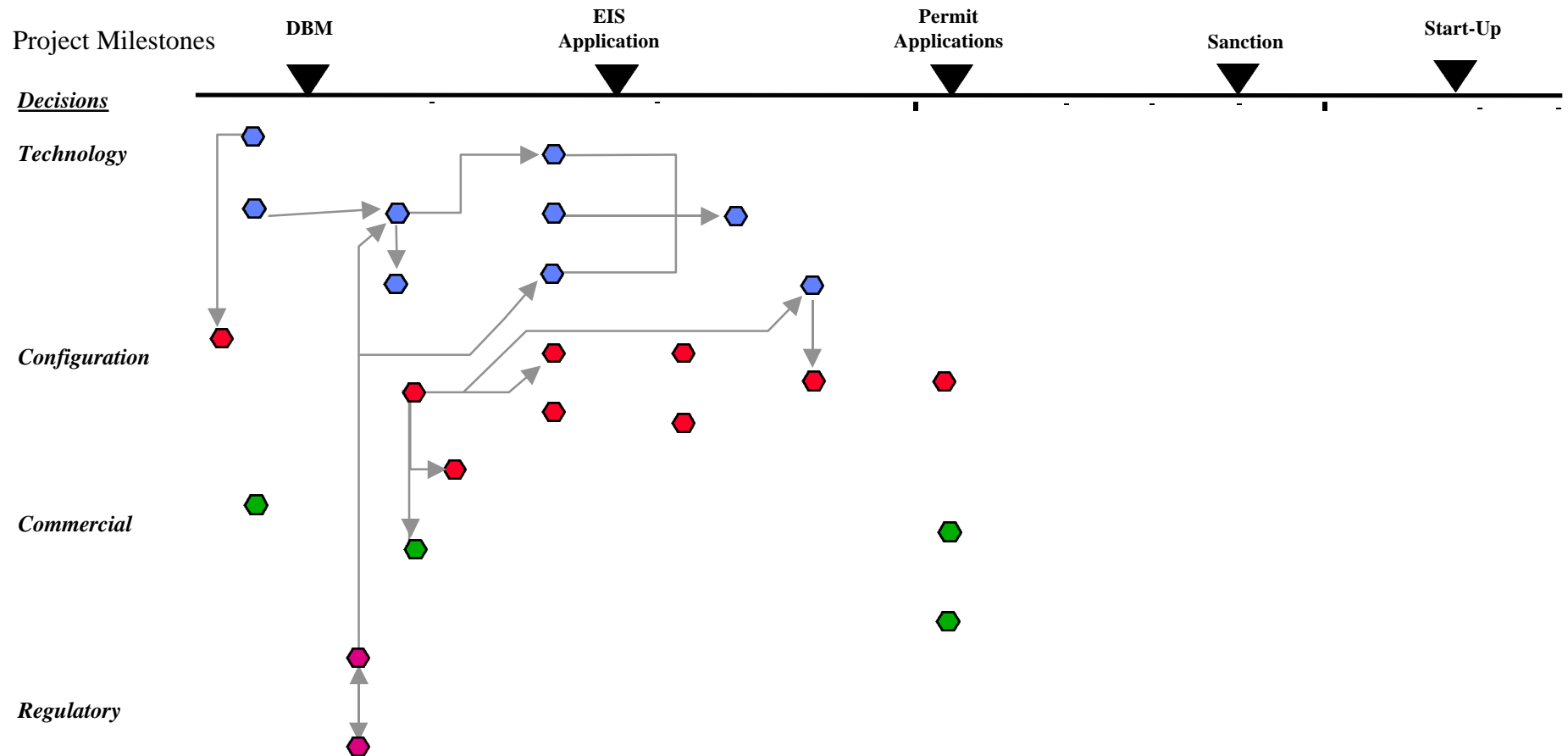
A STRATEGY TABLE

Clarifies all the alternatives to be studied on a single document.

Location	Environment	Mode	Product Temperature	Route
Offshore Portion	Deep Water	Single Wall <ul style="list-style-type: none">• low d/t• conventional	Warm	_____
	Shallow Water	Double Wall <ul style="list-style-type: none">• all steel• fiberglass & steel• steel and HDPE	Ambient	_____
Onshore Portion	Cross Country	Above Grade Buried	Refrigerated	_____
	River Crossings	Bridge Buried Drilled	Warm Ambient Refrigerated	_____ _____ _____

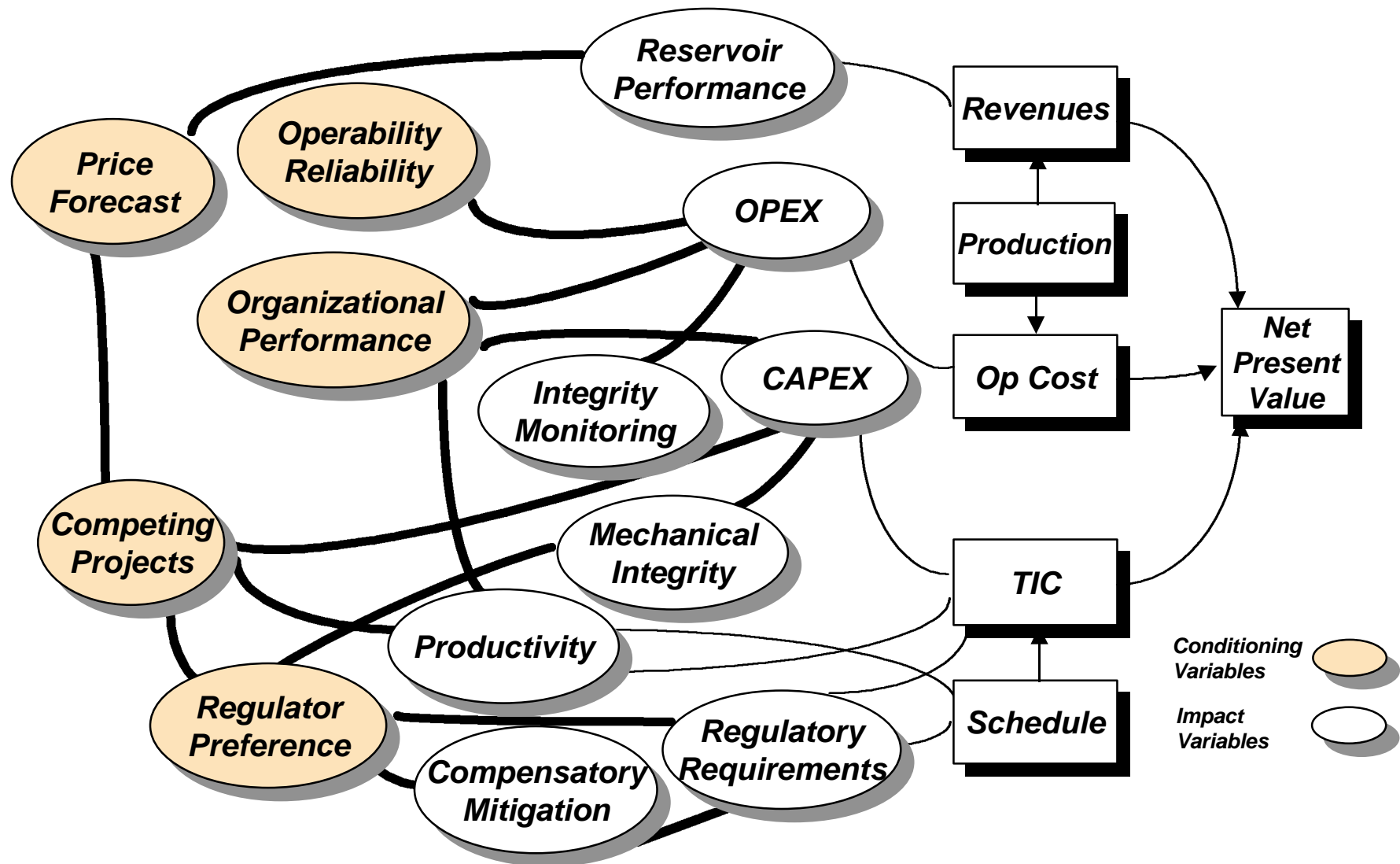
THE DECISION MAP

Lays out the key project decisions on a timeline and indicates the logic amongst decisions.

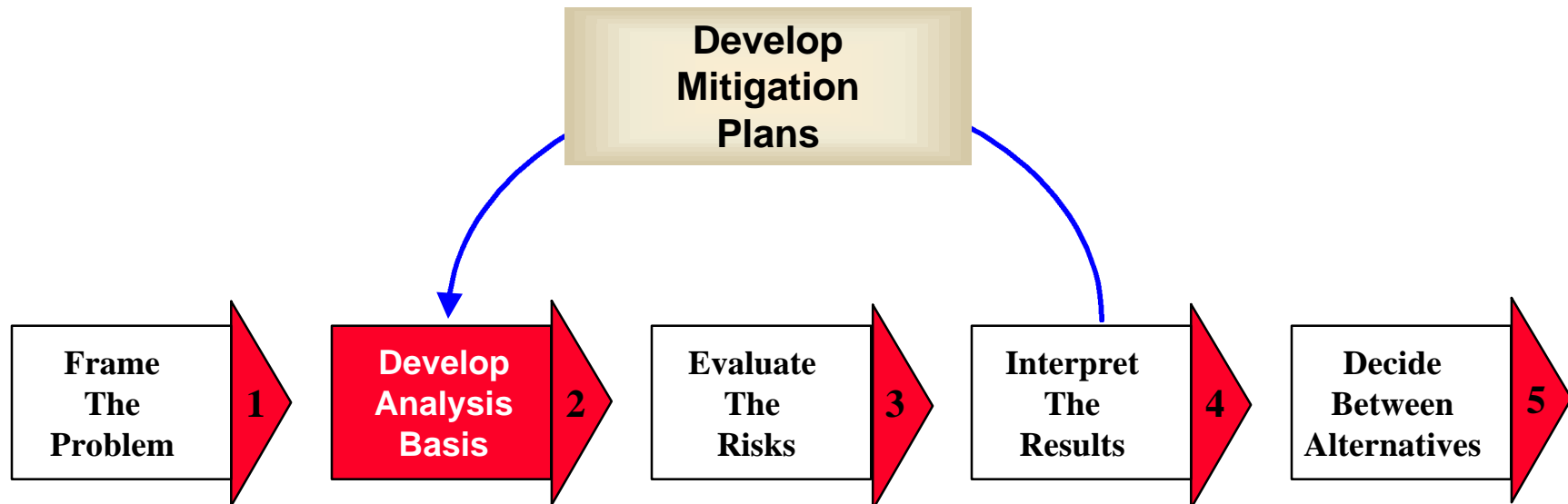


THE INFLUENCE DIAGRAM

*Shows how the risks influence each other and the value of the project.
Correlations between variables must be properly assessed and modeled.*



THE RISK & DECISION ANALYSIS PROCESS

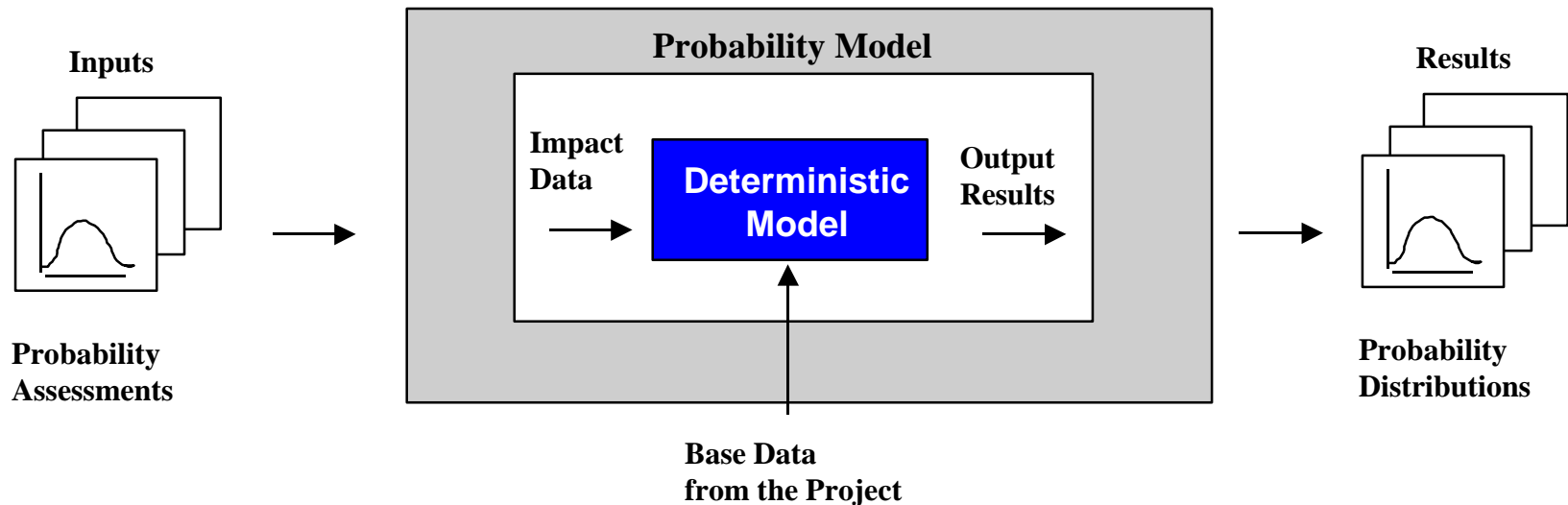


Model how
uncertainties
interact to influence
outcomes.

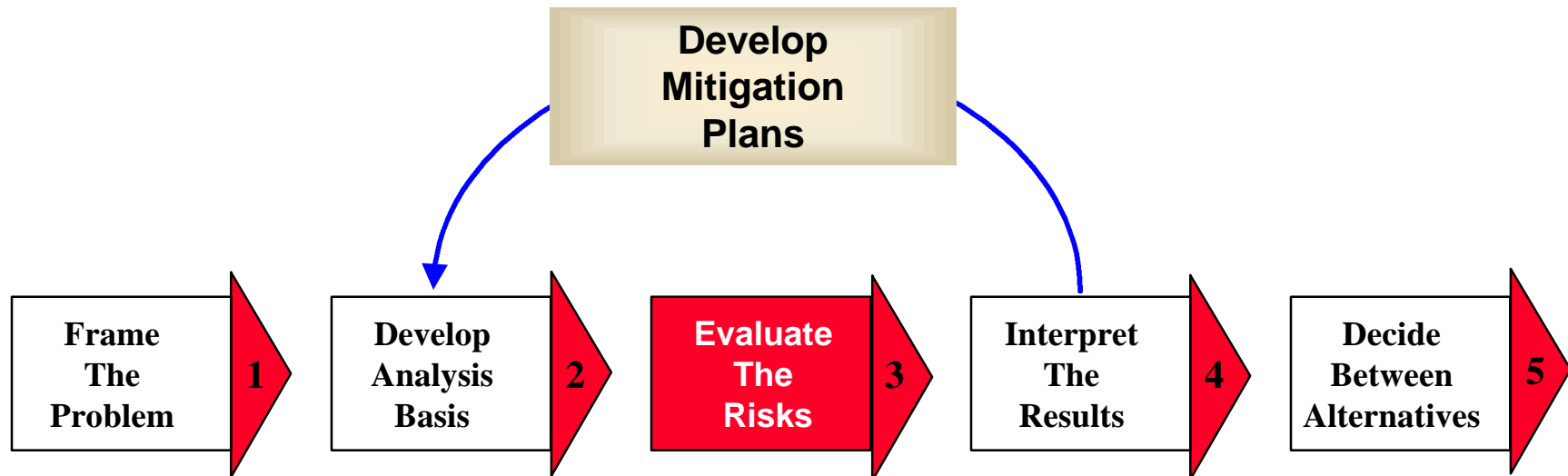
THE RISK MODEL

Requires well-defined decision criteria.

- ◆ *Project objectives and preferences establish the **decision criteria**.*
- ◆ *The values and interests of **all stakeholders** must be considered.*
- ◆ *Deal with **perceived risks**; the analysis will establish which ones are significant concerns.*



THE RISK & DECISION ANALYSIS PROCESS



Identify the Experts in each area of risk.

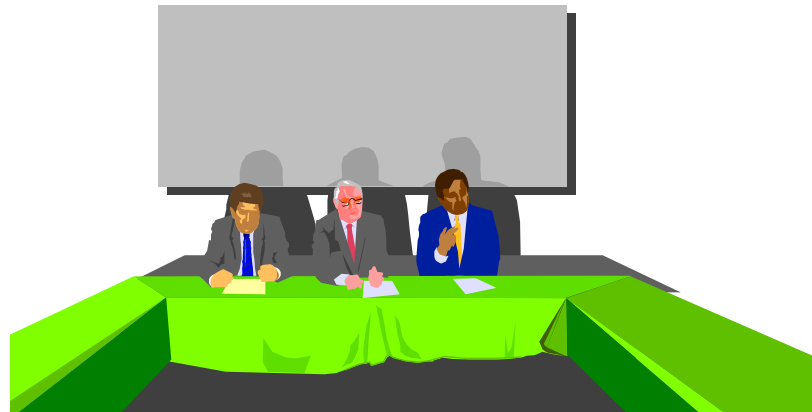
Assess the impact and the probability of occurrence for each uncertain variable.

THE EVALUATION STEP

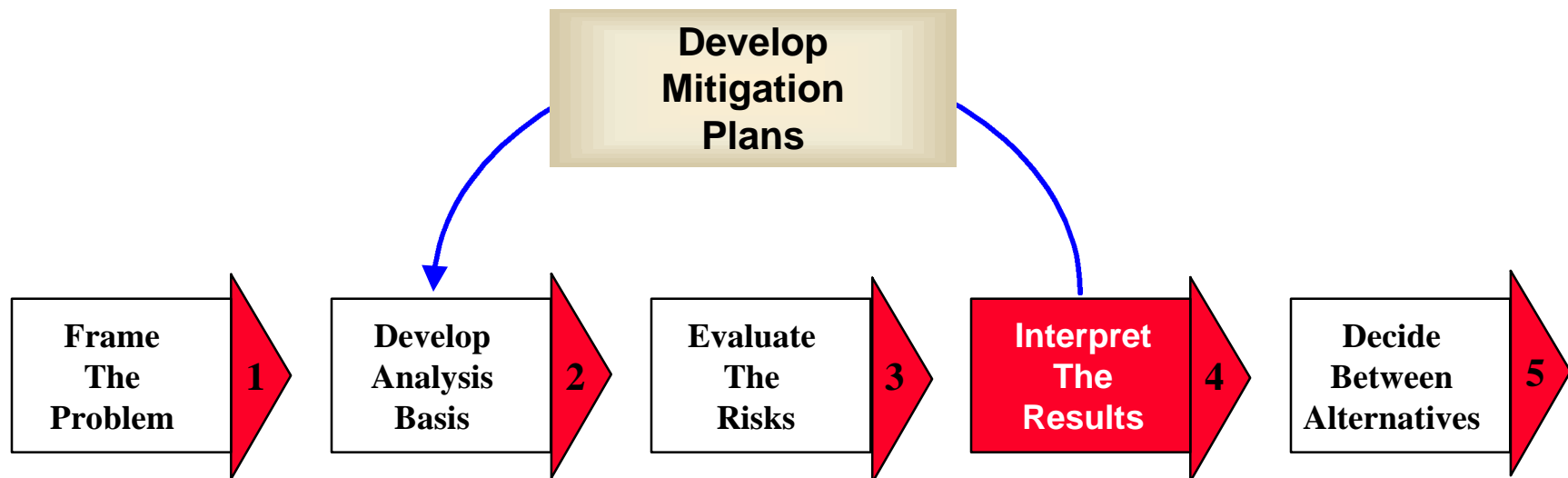
Key to the success of the process.

*“Experts” are selected based on their **knowledge** and **credibility**.*

*Experts assess the **likelihood** of occurrence for each major variable and its probable **impact** on results.*



THE RISK & DECISION ANALYSIS PROCESS



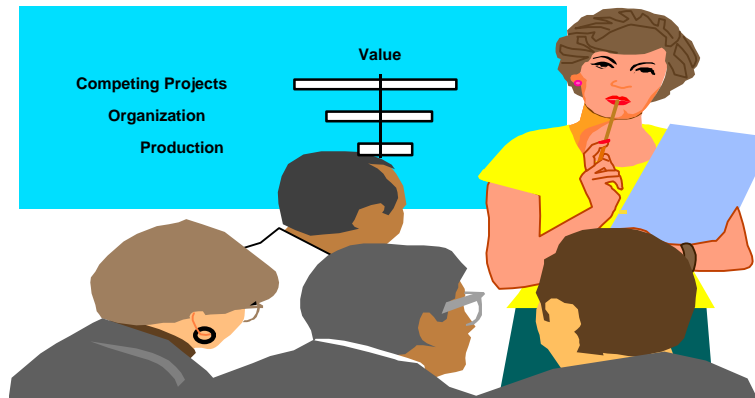
Calculate the uncertainty in the key risk areas.

Quantify the risks and opportunities for each scenario.

Analyze and document the results.

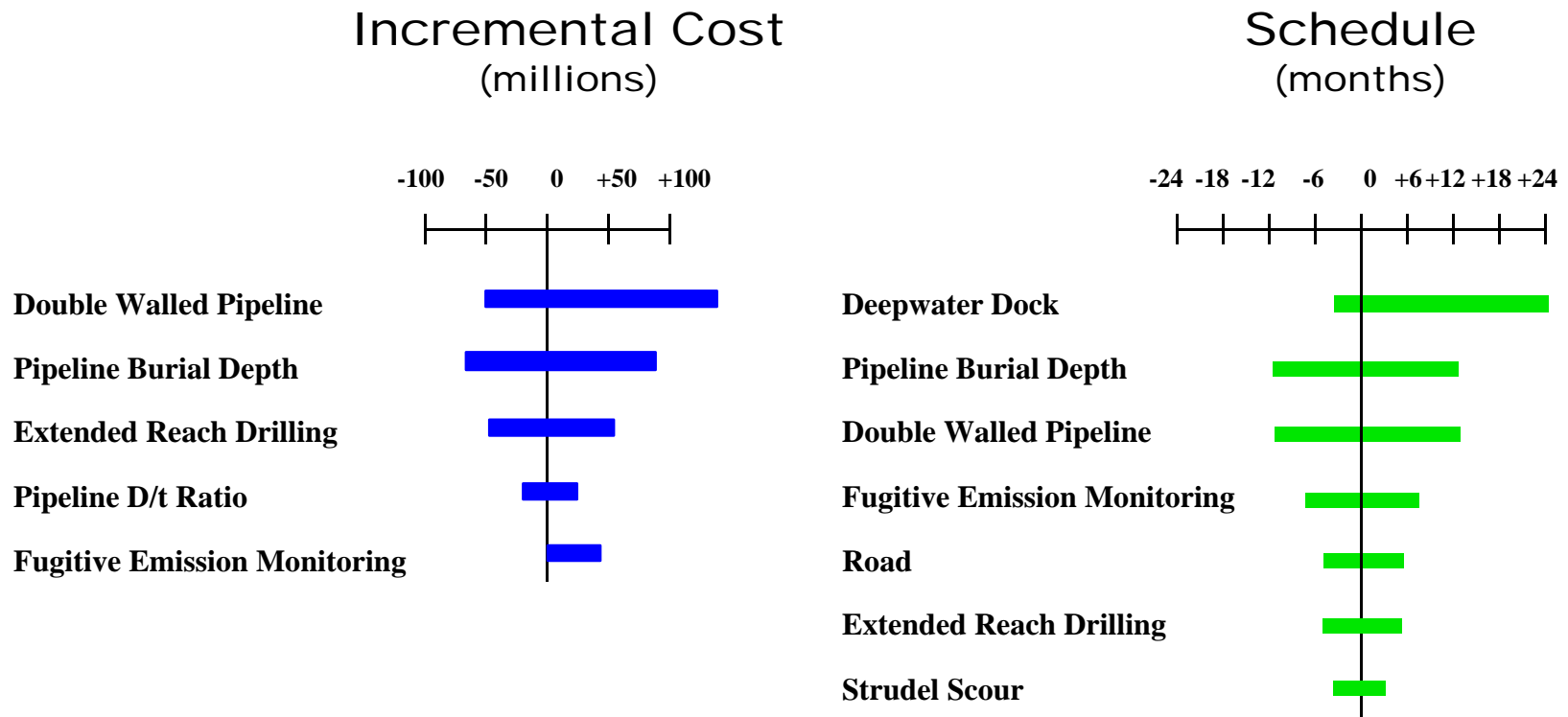
THE INTERPRETATION STEP REQUIRES

- ♦ A *sensitivity analysis* on each of the strategies to establish the key risk variables.
- ♦ *Probability distributions* to compare “risk adjusted” results.
- ♦ *Feedback* of early results to confirm the logic, and to focus attention on the most important risks.
- ♦ *Develop Risk Mitigation Plans*.
- ♦ *Recycle* to evaluate alternate project development concepts.

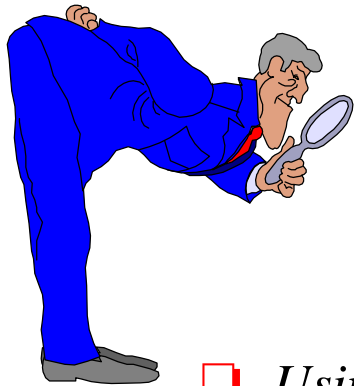


THE TORNADO DIAGRAM

Indicates the key contributors to the uncertainty. These are the prioritized risk issues for which mitigation should be considered.



Risk Analysis for Quality Decision Making



❑ *It builds stakeholder confidence that all the major environmental and permitting risks which could impact the project have been analyzed.*

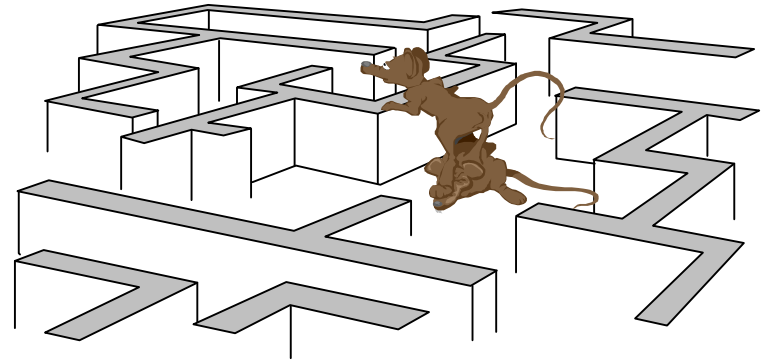
❑ *Using risk analysis provides a basis for decision making which **considers perceptions and uncertainties.***

❑ *The process provides an analytical method to **optimize the project plan** with respect to permitting and environmental risks.*

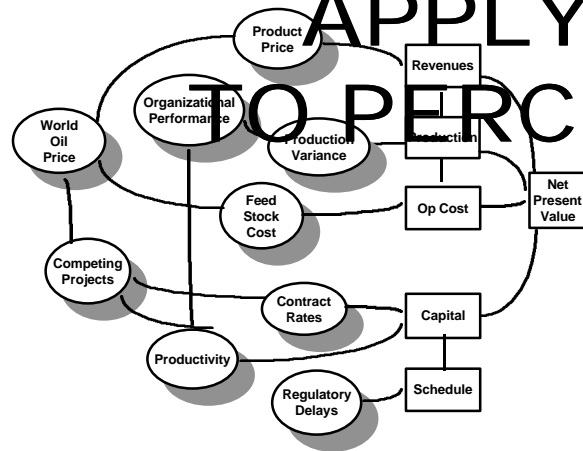


Using Risk and Decision Analysis promotes team building and improves communications on the project.

- ➔ *It helps clarify the project planning maze by **improving communication** about risks and risk mitigation opportunities.*
- ➔ *It substitutes **rational analysis** for emotion and prejudice in dealing with perceived environmental and permitting risks.*
- ➔ *It provides a vehicle for **risk mitigation planning**.*



APPLYING RISK ANALYSIS TO PERCEIVED PROJECT RISKS



**Develop
Mitigation
Plans**



- *Regulators*
- *Management*
- *Project team*
- *Technical specialists*
- *Construction specialists*
- *Environmentalists*